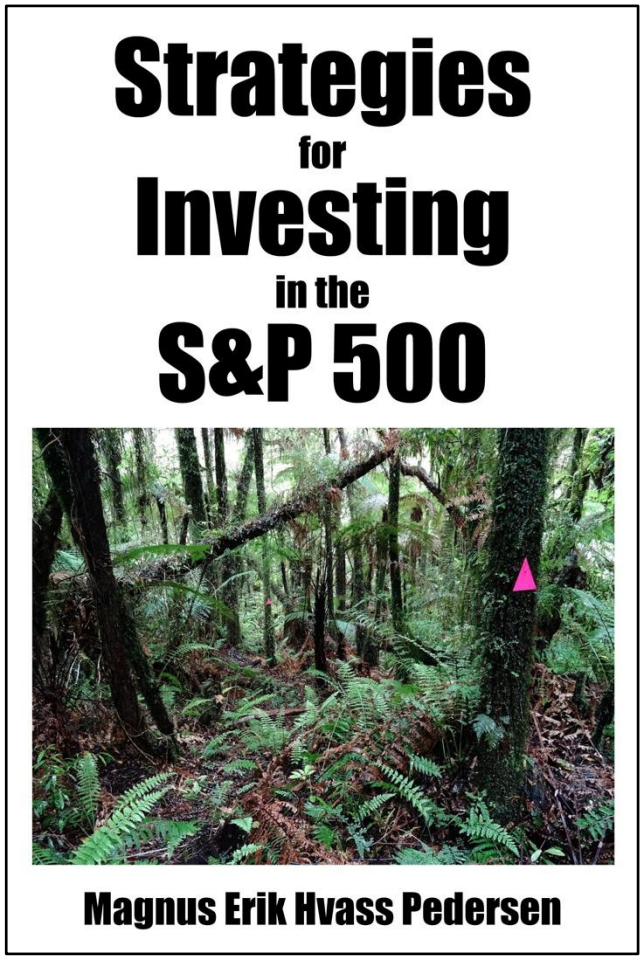

S&P 500 – Stop-Loss Strategies

(Part 5)

By

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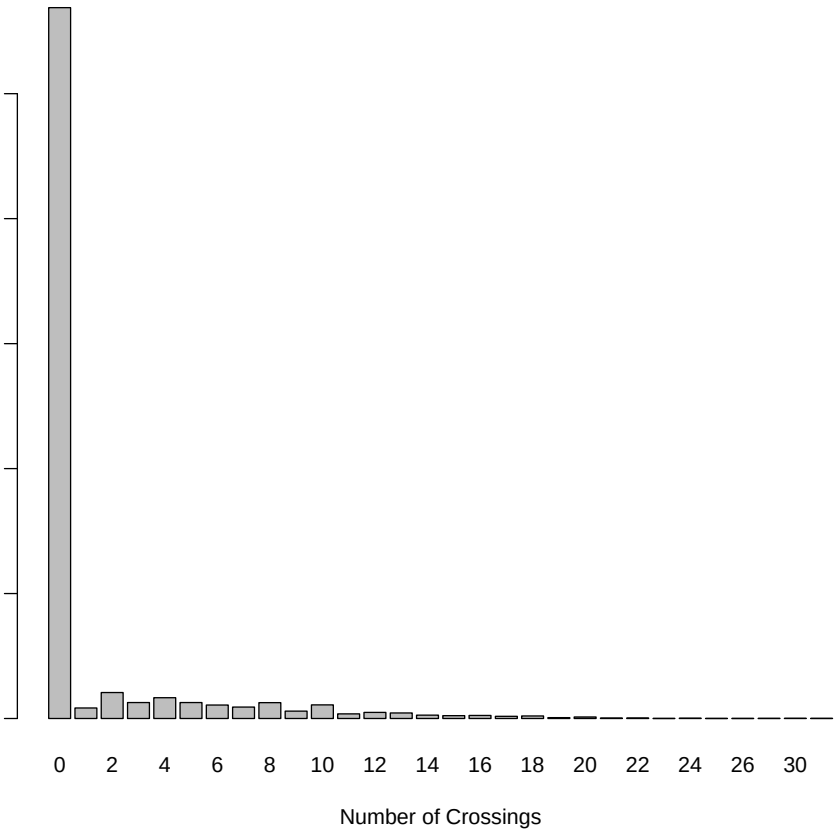
Rebalancing Without Stop-Loss

- The book has several adaptive strategies which annually rebalance between the S&P 500 and US Gov. Bonds.
- The stock-weight is the part of the portfolio invested in the S&P 500. It is calculated using the P/Book for the S&P 500 and the bond yield.
- Historically, the strategies had limited losses during 1978-2013.
- But future losses may be greater because the strategies are sometimes fully invested in the S&P 500 if the P/Book is low.

Rebalancing With Stop-Loss

- If losses must be strictly limited then stop-loss orders must be used.
- If S&P 500 drops e.g. (15%) below purchase price then it is sold.
- If S&P 500 increases above the stop-price then it is repurchased.
- The stop-loss strategy also uses annual rebalancing between the S&P 500 and US Government Bonds.
- Stock-weight is calculated using P/Book of S&P 500 and bond yield.
- After each year the portfolio is rebalanced regardless of share-price.

Number of Stop-Price Crossings



The stop-loss strategy sells and repurchases S&P 500 each time the stop-price is crossed, e.g. (15%) below the purchase price.

Histogram counts the number of times the stop-price is crossed within a year.
Daily price-data for 1978-2013.

Stop-Loss Frictional Cost

We may not be able to sell and repurchase exactly at the stop-price.

The frictional cost is modelled as a penalty factor:

$$Penalty = (1 - 0.5\%)^{Number\ of\ Stop\ Price\ Crossings} = 0.995^{Number\ of\ Stop\ Price\ Crossings}$$

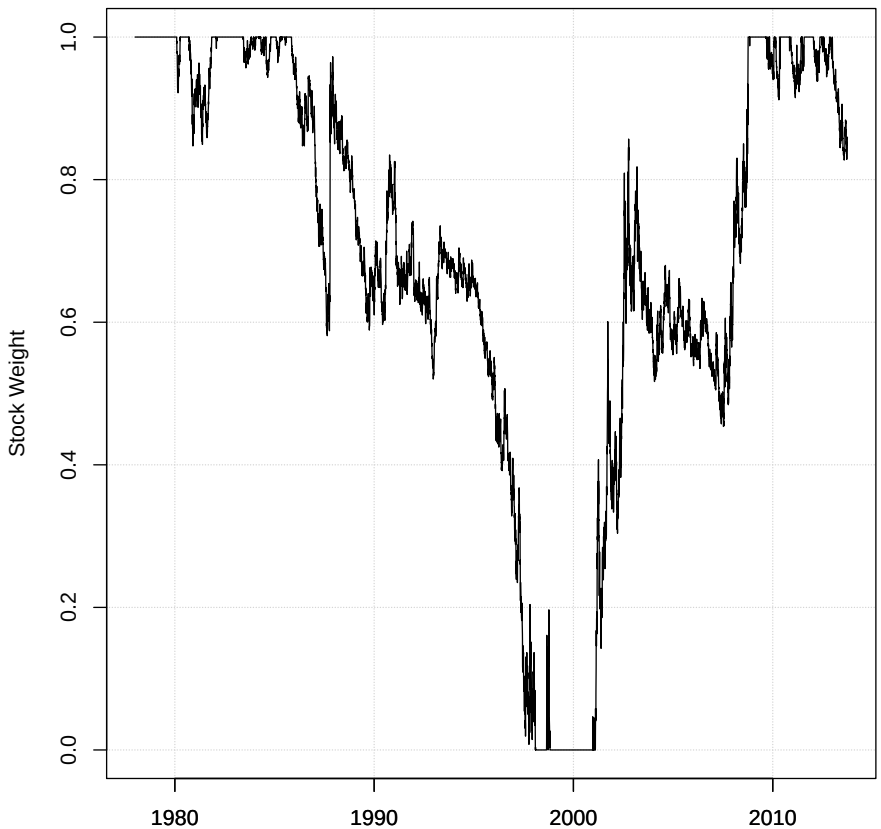
Example: If a year has 15 stop-price crossings then the penalty factor is:

$$Penalty = 0.995^{Number\ of\ Stop\ Price\ Crossings} = 0.995^{15} \approx 0.928$$

If return was 5% then the penalized return would be a loss of (2.6%):

$$Penalized\ Return = Penalty\ x\ (1 + Return) - 1 = 0.928\ x\ (1 + 5\%) - 1 \approx (2.6\%)$$

Stock Weight – Medium Risk Stop-Loss Strategy



The stock-weight is the part of the portfolio invested in the S&P 500. It is calculated using the P/Book of the S&P 500 and the bond yield. The formula is:

Stock Weight = Limit(1.93 – 0.44 x P/Book – 3.14 x Bond Yield)

Limited between zero and one.

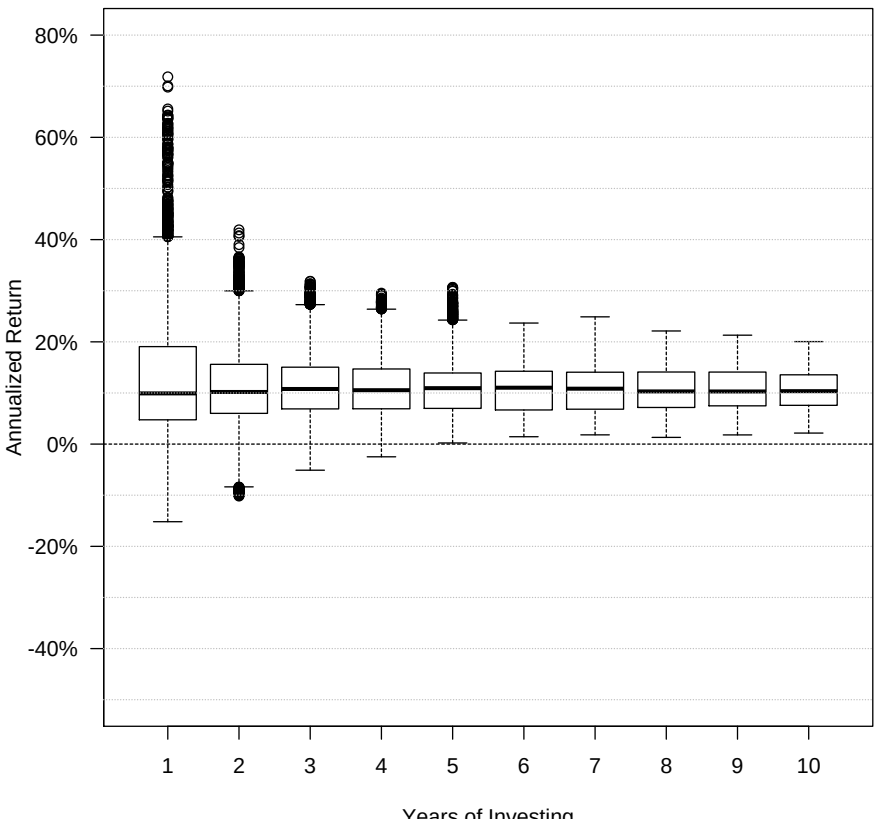
Example: Calculate the Stock Weight

On January 12, 1990 the P/Book was 2.31 and the bond yield was 7.8% so the stock-weight was:

$$\textit{Stock Weight} = \textit{Limit}(1.93 - 0.44 \times \textit{P/Book} - 3.14 \times \textit{Bond Yield})$$
$$= \textit{Limit}(1.93 - 0.44 \times 2.31 - 3.14 \times 7.8\%) = 0.67$$

So 67% of the portfolio should be invested in the S&P 500 and the remainder in US Government Bonds with 1-year maturity.

Med. Risk Stop-Loss – Annualized Return (1978-2013)



Back-test Medium Risk Stop-Loss strategy for all possible starting dates and investment periods up to 10 years during 1978-2013.

Box-plot shows statistics for the annualized return.

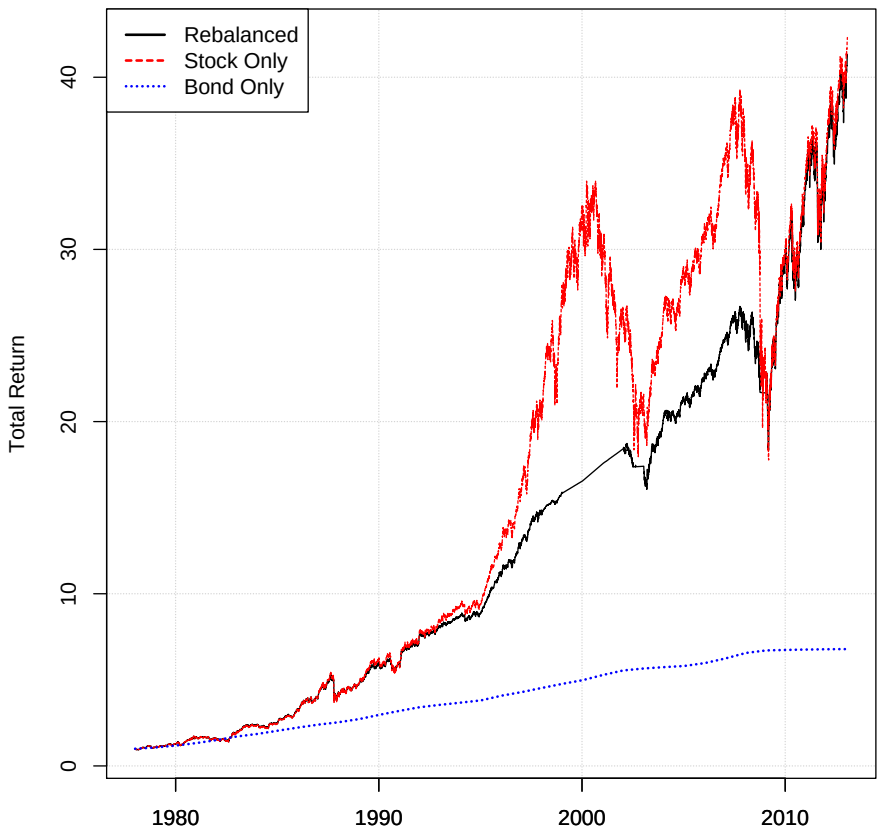
This can also be shown in a table...

Med. Risk Stop-Loss – Annualized Return (1978-2013)

Years of Investing	Min	1st Qrt.	Median	Mean	3rd Qrt.	Max	Stdev	Probability of Loss	Probability < Bond-Only	Probability < Stock-Only
1	(15.2%)	4.8%	9.9%	11.8%	19.1%	71.8%	12.6%	0.15	0.23	0.60
2	(10.2%)	6.0%	10.2%	11.2%	15.6%	41.9%	7.7%	0.06	0.17	0.62
3	(5.1%)	6.9%	10.8%	11.0%	15.0%	31.8%	6.1%	0.03	0.16	0.63
4	(2.5%)	6.9%	10.5%	10.9%	14.7%	29.5%	5.5%	0.01	0.13	0.61
5	0.2%	7.0%	10.9%	10.8%	13.9%	30.7%	5.1%	0	0.08	0.57
6	1.4%	6.7%	11.0%	10.7%	14.3%	23.7%	4.6%	0	0.04	0.55
7	1.8%	6.8%	10.8%	10.8%	14.1%	24.9%	4.5%	0	0.01	0.57
8	1.3%	7.2%	10.3%	10.7%	14.1%	22.1%	4.3%	0	0.01	0.62
9	1.8%	7.5%	10.3%	10.6%	14.1%	21.3%	4.0%	0	0.02	0.69
10	2.2%	7.6%	10.4%	10.5%	13.6%	20.1%	3.8%	0	0.02	0.72

Example: Investing for 2 years had mean annualized return 11.2%, min (10.2%), max 41.9%, stdev 7.7%. Investing for 10 years had mean 10.5%, min 2.2%, max 20.1%.

Long-Term Relative Performance (1978-2013)



In this 35 year period the Medium Risk Stop-Loss strategy performed about as well as the S&P 500 but avoided the peaks and crashes around year 2000 and 2008.

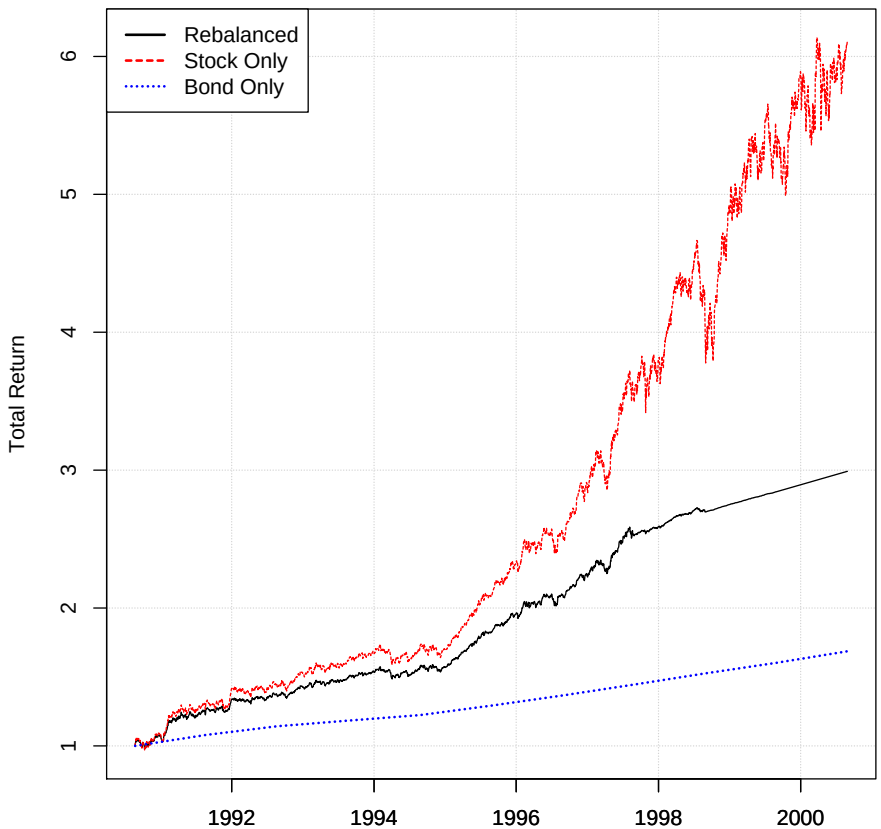
But what about shorter investment periods?

Example: Rebalancing is BETTER Than S&P 500

Example of the Medium Risk Stop-Loss strategy performing better than both the S&P 500 and US Gov. Bonds.

Investment period is 10 years.
Starting date is March 3, 2000.

Example: Rebalancing is WORSE Than S&P 500



Example of the Medium Risk Stop-Loss strategy performing worse than the S&P 500 and better than US Gov. Bonds.

Investment period is 10 years.
Starting date is August 23, 1990.

Probability of Under-Performance

Medium Risk Stop-Loss Strategy				
Years of Investing	(...)	Probability of Loss	Probability < Bond-Only	Probability < Stock-Only
1	(...)	0.15	0.23	0.60
2		0.06	0.17	0.62
3		0.03	0.16	0.63
4		0.01	0.13	0.61
5		0	0.08	0.57
6		0	0.04	0.55
7		0	0.01	0.57
8		0	0.01	0.62
9		0	0.02	0.69
10		0	0.02	0.72

- These are historical probabilities (frequencies) for 1978-2013.
- Probability of loss decreases with longer investment duration.
- Probability of under-performing US Gov. Bonds decreases with longer investment duration.
- Probability of under-performing S&P 500 is high at 0.55-0.72.

Conclusion

- Stop-loss can be used to increase the average return while limiting losses.
- But stop-price may be crossed many times during a year and frictional costs may be high.
- So it is very important to trade close to the stop-price if strategies are to work.

The book gives more details and also studies other strategies.